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TAXONOMIC ACCOUNT OF *NICANDRA* (SOLANACEAE) IN AUSTRALIA

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Abstract

Nicandra, of which there is only one species, *N. physalodes* (L.) Gaertn., is a native of Peru and has become naturalized in many tropical and temperate regions of the world. In Australia it is a weedy species occurring mainly in cleared or disturbed sites and on cultivated ground, mostly in the eastern coastal region. A description of the species based on Australian material is presented and its distribution in Australia is mapped.

Introduction

Nicandra physalodes, the only species in the genus (family Solanaceae) and native to Peru, has become a well-established member of the Australian flora. It has been cultivated as an ornamental garden plant in Australia and elsewhere, and is now widely dispersed in tropical and temperate areas. *N. physalodes* has been suspected of poisoning stock, but feeding experiments in New South Wales in which the green berries and the plant were tested on sheep and a goat gave negative results (Hurst, 1942). Cohen (1970) documented a case of two ewes having died apparently as a result of grazing in a yard heavily infested with *N. physalodes*; their ruminal contents consisted almost entirely of fragments of *N. physalodes*. The plant is also said to be used as a fly poison (Hurst, 1942), but its poisonous principle is unknown (Everist, 1974), although believed to be an alkaloid (Willaman, 1961). The most recent Australia-wide account of *Nicandra* is that of Bentham (1868) who reported it as occurring only in New South Wales. *Nicandra* has become considerably more widespread since then and occurs, for instance, in South Australia although it is not listed in a flora of this State.

As a continuation of taxonomic reviews of solanaceous genera in Australia currently being conducted at the Herbarium of the Waite Institute, a taxonomic account of *N. physalodes* is presented here. Dried material examined for this study was from the following herbaria: AD, ADW, BRI, NSW and PERTH; material cultivated or adventive at the Waite Institute was also studied.

This plant was described as a species of *Atropa*, *A. physalodes*, by Linnaeus (1753). Boehmer (1760) and Adanson (1763) recognized it as being distinct from *Atropa* and described the genera *Physalodes* and *Nicandra* respectively to contain it; they did not publish specific epithets. Although *Physalodes* Boehmer antedates *Nicandra* Adans., the latter is conserved (ICBN, 1972, p.356). Gaertner (1791) referred Linnaeus' species *Atropa physalodes* to *Nicandra* Adans., but published it as *N. physaloides*. This spelling has been followed by a number of authors, but the original spelling must be retained (ICBN, 1972, article 62). Schönbeck-Temesy (1972) uses the name '*Nicandera* Adans., Fam. 2:219 (1763) "*Nicandra*"; orth. mut. Cothen., Disp. 21 (1790)'. However, according to the ICBN (1972) articles 62 and 73, the original spelling is not to be changed or "corrected".

The following key separates *Nicandra* from other solanaceous genera in Australia, from most of which it is readily distinguished.

- 1a. Fruit enclosed in a distinctly inflated calyx 2
- 1b. Fruit not enclosed in a distinctly inflated calyx other genera
- 2a. Stems and leaves with prickles and stellate hairs *Solanum* (A few species)

- 2b. Stems and leaves without prickles and stellate hairs, almost or entirely glabrous 3
- 3a. Corolla white or yellow; base of calyx lobes not, or shallowly, lobed or cordate 4
- 3b. Corolla blue to violet; base of calyx lobes deeply cordate or sagittate *Nicandra*
- 4a. Flowers solitary *Physalis*
- 4b. Flowers clustered *Withania*

NICANDRA Adans.

Nicandra Adans., Fam. Pl. 2: 219 (1763) (nom. cons.).

Physalodes Boehmer in Ludwig, Def. Gen. Pl. 41(1760).

Calydermos R. & P., Fl. Peruv. 2:43 (1799).

Alkekengi amplo flore violaceo Feuill., J.Obs. 2:724, pl.16 (1714) (pre-Linnaean phrase name).

Nicandra physalodes (L.) Gaertn., Fruct. Sem. Pl. 2:237(1791) ("*physaloides*").

Atropa physalodes L., Sp. Pl. 181(1753) (basionym).

Type citation: "Habitat in Peru. D.B.Jussieu".

Lectotype: LINN 246/3 (Schönbeck-Temesy, 1972) (n.v., microfiche AD!).

Physalis peruviana Mill., Gard. Dict. ed. 8, "PHY" no.16 (1768) (non L.) (fide Dunal, 1852).

Physalis daturaefolia Lam., Encycl. meth. 2:102(1768) (fide Dunal, 1852).

Calydermos erosus R. & P., Fl. Peruv. 2:44(1799) (fide Dunal, 1852).

Physalodes peruvianum (Mill.) Kuntze, Rev. Gen. Pl. 452 (1891) (fide Domin, 1929).

"*Atropa daturaefolia* Thore" (cited by Domin, 1929, in synonymy; in fact Thore (1803) was referring to, and used the name, *Physalis daturaefolia*.)

Nicandra minor hort. ex Fisch. et al., Index Sem. Hort. Petrop. 9:81. (1835) = *N. physalodes* (fide Fischer et al., 1835; Dunal, 1852).

N. brevicorollata Bitter, Beih. Bot. Centralbl. 14:173(1903).

N. macrocalyx Bitter, l.c. :169.

N. nana Bitter, l.c. :171.

N. nebulosa Bitter, l.c. :170.

N. parvimaclata Bitter, l.c. :168.

N. undulata Bitter, l.c. :176.

N. violacea André ex Lemoine, Rev. Hortic. 208(1906).

N. physalodes var. *arbiflora* (author not traced) quoted by Sinha (1951), perhaps in error for "*albiflora*"?

N. physalodes var. *latifolia* Dun. in DC., Prodr. 13:434(1852) "foliis late ovatis majoribus. Ex insula Mauritii".

N. physalodes f. *typica* Dahlgren, Hereditas 5:228(1924) (nom.illeg.)

N. physalodes f. *immaculata* Dahlgren, l.c.

Common Name: "Apple of Peru"

Annual herb with upright, sulcate, glabrous stems, to 2 m high or more. *Leaves* alternate petiolate, narrowly to broadly ovate; *lamina* (2-)4-21(-31) cm long x (1-)2-10(-18) cm wide; *apex* acute to acuminate, rarely obtuse; *base* cuneate to narrowly cuneate or attenuate, rarely obtuse; *margin* usually widely, irregularly and shallowly dentate or sinuate-dentate, occasionally deeply so (rarely cleft), or almost entire; upper laminal surface sparsely to very sparsely covered with short, inflated, eglandular trichomes 2-4 cells long, the basal cell subglobular, lower laminal surface glabrous or nearly so; *petiole* (0.5-)1.5-6.5 (-9)cm long, usually narrowly winged distally to almost terete proximally.

Inflorescence pseudaxillary or rarely interfoliar, flowers solitary, pedicellate and somewhat cernuous; *pedicel* 6-24 mm long (longer in fruit), recurved and sparsely to moderately puberulent (becoming glabrous in fruit). *Calyx* usually glabrous, occasionally sparsely puberulent, 5-lobed; *lobes* (7-)9-20(-22) mm long, ovate, acute to acuminate (rarely obtuse) and often slightly mucronate at the apex, sagittate (occasionally cordate) at the base and often mucronate at the basal tips, lobes mutually adpressed along margins to form longitudinal wings (and also fused along the margins for 1/3(-1/2) their length from basal tips). *Corolla* 5-lobed, broadly campanulate, pale blue to mauve on limb and upper tube, and

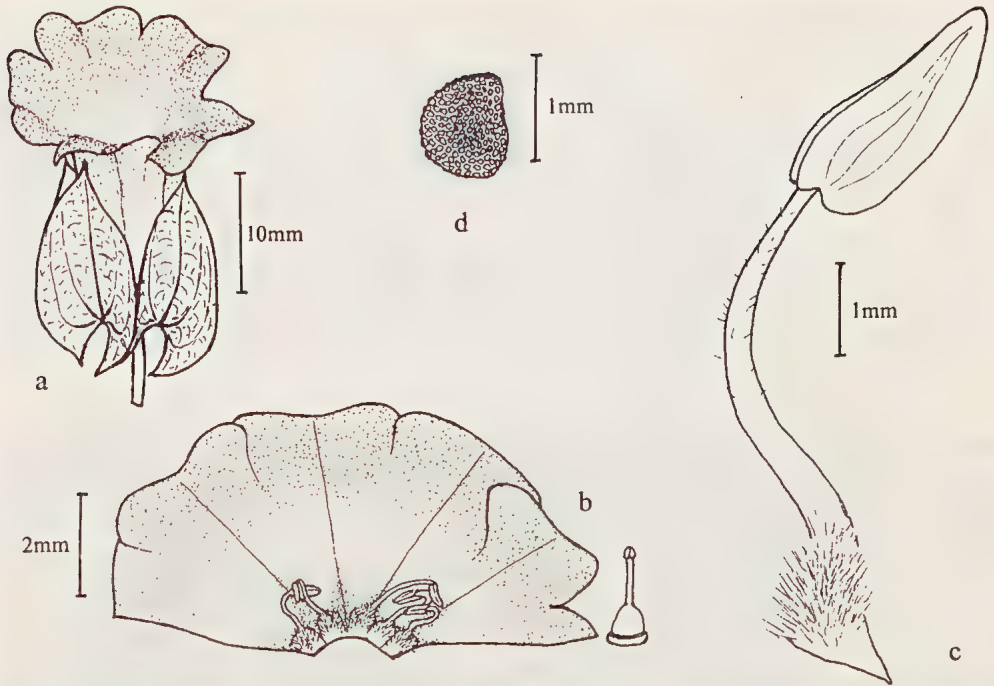


Fig. 1. *Nicandra physalodes*. a) flower; b) opened corolla with stamens, and pistil; c) stamen; d) seed. (P. Horton s.n., ADW 51288).

on lower part of tube whitish with blue spot near base of each lobe; *limb* slightly lobed, plicate in bud; *lobes* alternate with calyx-lobes, 12-23(-30) mm long, 5-15(-22) mm wide, margin usually entire and obtuse, occasionally slightly emarginate. *Stamens* 5, included, alternate with corolla lobes; *filaments* 3-5.5 mm long, inserted near base of corolla tube, densely pubescent on dilated bases; *anthers* yellow, ovate or oblong-ovate with 2 parallel thecae, 1.8-4 mm long, dorsifixed, longitudinally dehiscent. *Ovary* divided (often irregularly) into 3-5 locules; ovules numerous; *disc* hypogynous, flattened, annular; *style* 3-6 mm long, relatively thick; *stigma* capitate with 3-5 prominent stigmatic areas. *Fruit* a globular, pale yellowish, almost dry berry, the outer wall chartaceous and when ripe splitting irregularly at the base (which is usually uppermost in the pendulous fruit), (5-) 11-22 mm diameter, enclosed in the accrescent, chartaceous, reticulate calyx. *Seeds* brown, numerous (in 6 berries counted, the number of seeds ranged from 69 to 638), compressed, subdiscoid to broadly reniform and usually asymmetrically so, 1.2-2.1 mm long, testa reticulate-foveate. (Fig. 1)

Chromosome number

Several authors have obtained the somatic chromosome number $2n = 20$ (e.g. Vilmorin & Simonet, 1928; Darlington & Janaki-Ammal, 1945; Venkateswarlu & Rao, 1963). However, the chromosome number still seems to be uncertain, as Darlington & Janaki-Ammal (1945) found it sometimes to be $2n = 19$ by loss of one of a pair of isochromosomes; Sinha (1951) obtained counts of $2n = 21$ in the variants "arbiflora" and "violacea"; Gill (1971) found the haploid number to be $10 + 1B$, and Sharma and Sarkar (1967-68) reported a count of $n = 11$. No counts based on Australian material have been noted.

Distribution and habitat in Australia

Nicandra in Australia is primarily a summer- and autumn-growing annual and occurs principally in higher rainfall areas of the eastern states, particularly around populous

centres. Most collections of *N. physalodes* have been made from New South Wales and Queensland, with fewer specimens from Victoria, Tasmania, South Australia and Western Australia (Fig. 2). Two of the South Australian collections, *J.M. Black*, 19.v.1932 (AD 97615160) and *B. Frost*, 6.iv.1970 (AD 97015458), are annotated as being adventive in gardens. Likewise at the Waite Institute the species persisted in 1978 around the area where it had been cultivated the previous year. Possibly most or all of the southern and western collections are of plants persisting after cultivation, and can be considered as naturalized in these areas. No collection of *N. physalodes* from the Northern Territory has been located, (none are held at DNA or NT), but Holtze (1892) reported it as having been introduced there. *N. physalodes* grows in a wide variety of soil types, often on the margins of paddocks or amongst pasture or crops such as lucerne, oats, peas and maize, or on cleared or disturbed land. It has been reported as an important pest species in maize crops on the Atherton Tableland in Queensland (Hawton, 1976).

Notes

Bitter (1903) studied *Nicandra* in detail and distinguished a number of different species, listed previously. The characteristics by which he distinguished these species seem to fall within a range of continuous variation normally encountered in *N. physalodes* and to be insufficient to justify specific rank.

N. violacea André ex Lemoine was distinguished from *N. physalodes* by its prominently blue corolla and suffused purple of the calyx, stems, petioles and peduncles, and the scattered coloured hairs on the upper surface of the leaves. Darlington & Janaki-Ammal



Fig. 2. Distribution of *Nicandra physalodes* in Australia.

(1945) consider that this variation does not constitute a distinct species, and suggested, as did Bailey (1943), that it may be merely a variety or variant of *N. physalodes*. It may be no more than a variant with well developed anthocyanin pigment.

Darlington & Janaki-Ammal (1945) considered that *N. physalodes* f. *immaculata* Dahlgren (which lacks the corolla spots) is merely a simple genetic variant, similar to two additional variants which they listed: *violacea* (corresponding with *N. violacea* André ex Lemoine) and *alba* (with white instead of blue flowers). There is no evidence to suggest that any of these form stable populations or have a geographical basis.

Recent authors (often flora-writers such as Gentry & Standley, 1974, and MacBride, 1962) consider the genus *Nicandra* to be monotypic, and in the absence of a monographic treatment since that of Bitter (1903) this view is followed here. Most recent authors also do not recognize varieties or forms of *N. physalodes*.

Of the Australian specimens seen, only one is distinct (*R. Coveny* 6574, annotated: “. . . stems violet, fruit calyx papery and violet-coloured at base”); it corresponds with Bailey’s (1943) concept of “*N. violacea* André”. However, in all other characteristics it resembles the other specimens seen, and its separation as a distinct species or even variety seems unjustified; it appears to constitute nothing more than a variant, such as Darlington & Janaki-Ammal (1945) proposed. No other Australian specimens are distinct, therefore they are all considered to be *N. physalodes*. This lends support for current considerations of *Nicandra* as a monotypic genus.

N. physalodes in Australia corresponds closely in morphology with its representatives in other countries, according to descriptions of the latter such as in MacBride (1962), Gentry & Standley (1947), etc. The only exception appears to be in the dimensions of the flower, which on average are slightly smaller in Australian specimens. As in other regions, the species in Australia is very variable in morphology. For instance, in cultivation, individual plants have matured when only about 10 cm high whereas others grow to more than 2 m. The leaf dimensions vary in proportion with the size of the plant and as in a number of solanaceous plants the juvenile leaves may be very large and lush when compared with leaves on distal flowering branches. This range in leaf size is rarely represented in herbarium specimens. The degree of variability shown by *N. physalodes* is common in widely spread weedy species (such as *Chenopodium album* L., *Solanum americanum* Mill. and *Sonchus oleraceus* L.) and like these *N. physalodes* is adaptable to many different environments.

Selection of Specimens (Total Seen: 76)

QUEENSLAND: *J.G. Chinning* s.n., Mount Beagle, Dec. 1916 (BRI 230771); *L. Durrington* 492, Serpentine Creek and environs, ca. 11 km N.E. of Brisbane, Jan. 1973 (BRI); *J.M. Swan* 130, Kuranda Railway Station, Aug. 1974 (ADW); *D.E. Symon* 4749, near Tolga, 17.v.1967 (ADW, BRI); *C.T. White* s.n., Gatton, 7.v.1925 (BRI 230772 and 230773); *R.W. Williams* B63, “Bilarabyn”, Veresdale, 8.ii.1965 (BRI).

NEW SOUTH WALES: *D.F. Blaxell* 1335, Dr George Mountain, 20.iv.1974 (NSW); *J.L. Boorman* s.n., Jerseyville, Macleay River, June 1910 (NSW 141341); *E. Breakwell* s.n., Moruya, Dec, 1913 (NSW 141327); *S. Chadwick* s.n., Scone, Jan 1931 (NSW 141325); *J.B. Cleland* s.n., Kendall, 13.v.1917 (AD 97548386); *R.G. Coveny* 6574, Elderslie & Branxton roads junction, 1 km E-S-E. of Elderslie, 12.vi.1975 (ADW, BRI); *F. Duguid* s.n., Narrabri, Jan. 1922 (NSW 141324); *J.J. Fletcher* s.n., Elizabeth Bay, Sydney, 30.v.1890 (NSW 141337); *T.G. Hewitt* s.n., Lismore, May 1912 (NSW 141342); *L.A.S. Johnson* & *B.G. Briggs* s.n., Yarramundi Lagoon, 2.5 miles (ca. 4 km) S-S-W. of Richmond, 22.x.1966 (NSW 141335); *E.N. McKie* s.n., Llangothlin, 20.iv.1941 (NSW 141326); *F.A. Rodway* 6543, Pyree, Shoalhaven River flats, 2.vii.1933 (NSW); *H. Wenzholz* s.n., Grafton, March 1914 (NSW 141338).

VICTORIA: *Department of Agriculture* s.n., Bruthen, s.d. (MEL, n.v.); *F.M. Reader* s.n., Warracknabeal, 11.ii.1904 (MEL, n.v.); *H.S. Wheeler* s.n., Neerim, Gippsland, 12.ii.1912 (MEL, n.v.).

TASMANIA: *L.V. Lester Garland* s.n., Lagana, Jan. 1931 (K, n.v.).

SOUTH AUSTRALIA: *J.M. Black* s.n., Unley, Adelaide, 19.v.1932 (AD 97615160); *Department of Agriculture* 500, Millicent, 13.iv.1964 (ADW); *B. Frost* s.n., Bethel, 6.iv.1970 (AD 97015458); *W.E. Johnston* s.n., Port Lincoln, 22.xi.1949 (ADW 6293).

WESTERN AUSTRALIA: *Mrs Austin s.n.*, Middlesex, Mar. 1964 (PERTH); *J.N. Hutchinson s.n.*, Carnarvon, Sept, 1965 (PERTH); *S. Wilkes s.n.*, Busselton, Feb. 1969 (PERTH).

Nomina Exclusa

Nicandra amara (Aubl.) J.F. Gmelin, Syst. Nat. 2 : 677 (1791) = *Potalia amara* Aubl. (Potaliaceae) (fide Dunal, 1852).

N. indica (Lam.) Roem. & Schult., Syst. 4:682 (1819) (basionym *Physalis indica* Lam., Encycl. meth. 2:102 (1786)). Dunal (1852) considered this to be a species of *Physalis* (*P. minima* L.) Neither Lamarck nor Roemer & Schultes describe the corolla of this species, this being unknown to them, but from their descriptions of the remainder of the plant, it is likely to be a species of *Physalis*.

N. anomala Link & Otto, Ic.Pl. Sel. 77, t.35 (1828) = *Scopolia lurida* Dun. (fide Dunal, 1852). From Link & Otto's description, this species appears to belong to the genus *Scopolia*, not *Nicandra*.

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